



# NIST Community Resilience Planning Resources

*Worse Case Effects of Hurricanes, Fluvial Flooding, High  
Tides, and Sea Level Rise on DelDOT Assets Meeting  
University of Delaware, Lewes, Delaware  
October 30, 2017*

Stephen Cauffman, Research Engineer  
NIST, Engineering Laboratory

# Why Community Resilience?

- Communities are socio-technical systems
- Buildings and infrastructure enable social and economic function
- Social and economic needs and functions should drive the goals for performance of buildings and physical infrastructure
- All communities are exposed to hazards that can cause disruption to social and economic activity





# Challenges

- What should the community be resilient to?
- How to account for interconnected nature of social systems, buildings, and infrastructure?
- How to identify performance gaps (“measure”) resilience?

## Hazards

- Natural hazards
- Technological hazards
- Human-caused hazards
- Degradation



## Hazard Level

- Routine
- Expected
- Extreme

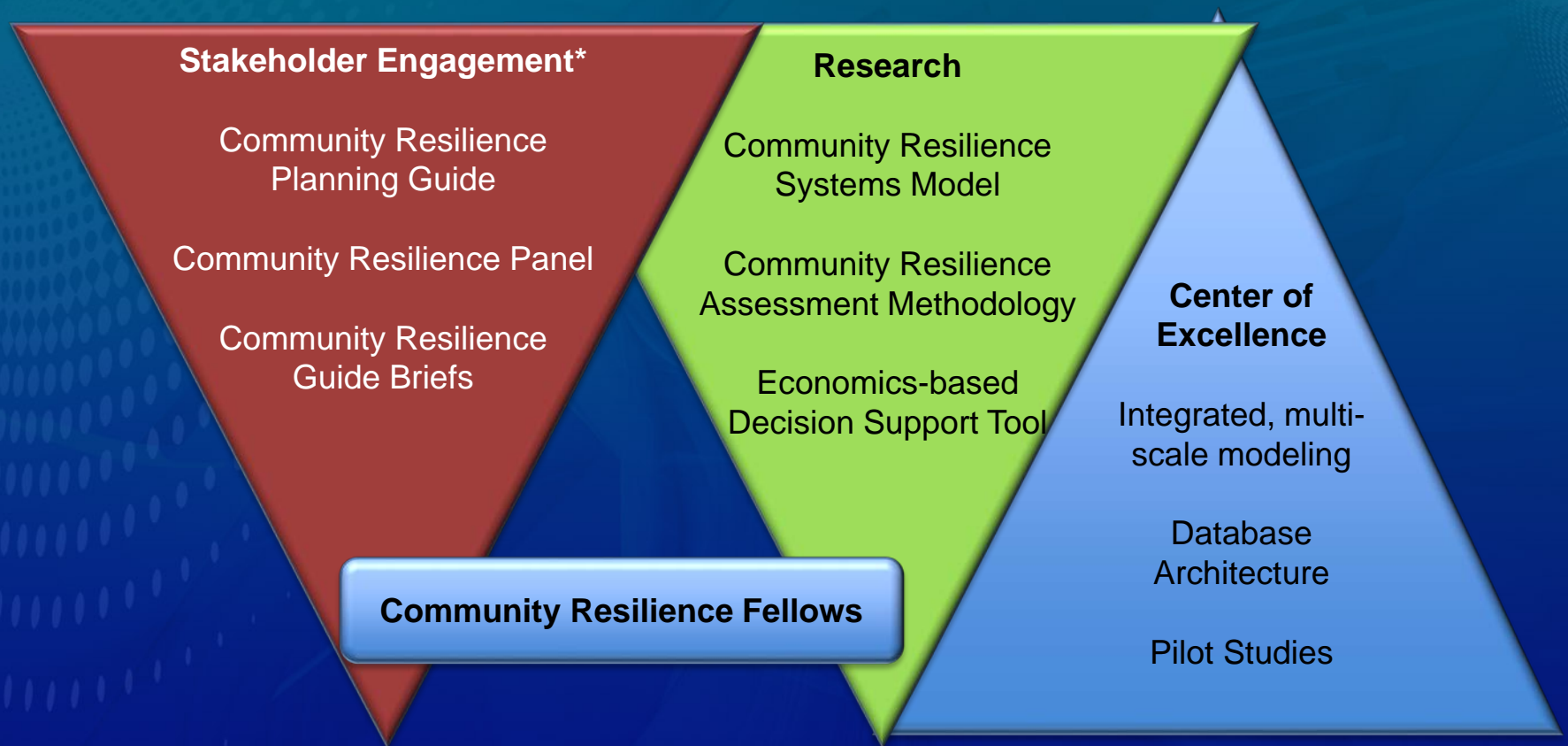


# What is Resilience?

- *“the ability to prepare for and adapt to changing conditions and to withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents.” (PPD 21)*
- Resilience can be thought of as what desired recovery looks like, expressed in terms of “time to recover function.”



# NIST Community Resilience Program





# Planning Guide Outline

## Volume 1 - Methodology

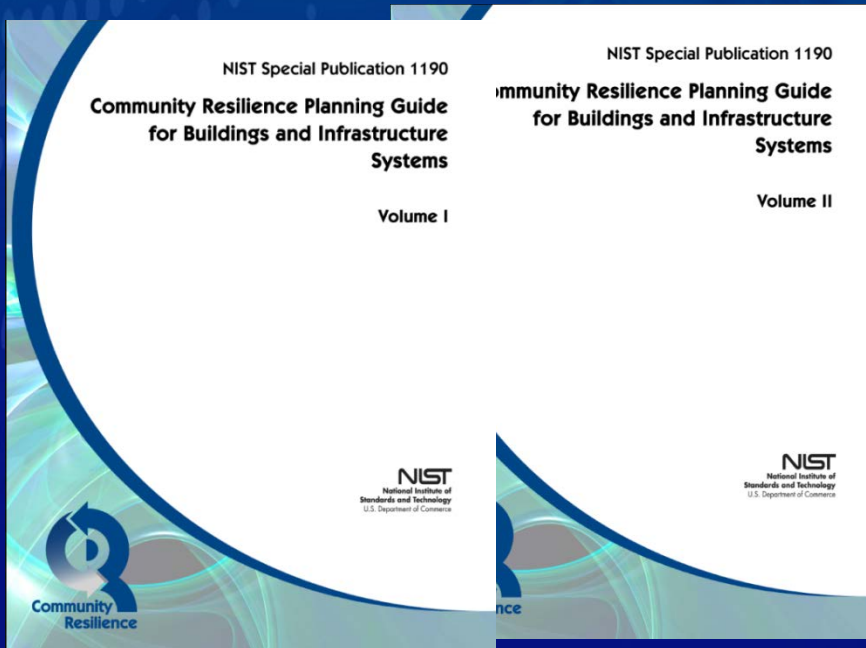
### Executive Summary

- Introduction
- 6 Step Methodology
- Planning Example – Riverbend
- Glossary and Acronyms

## Volume 2 - Reference

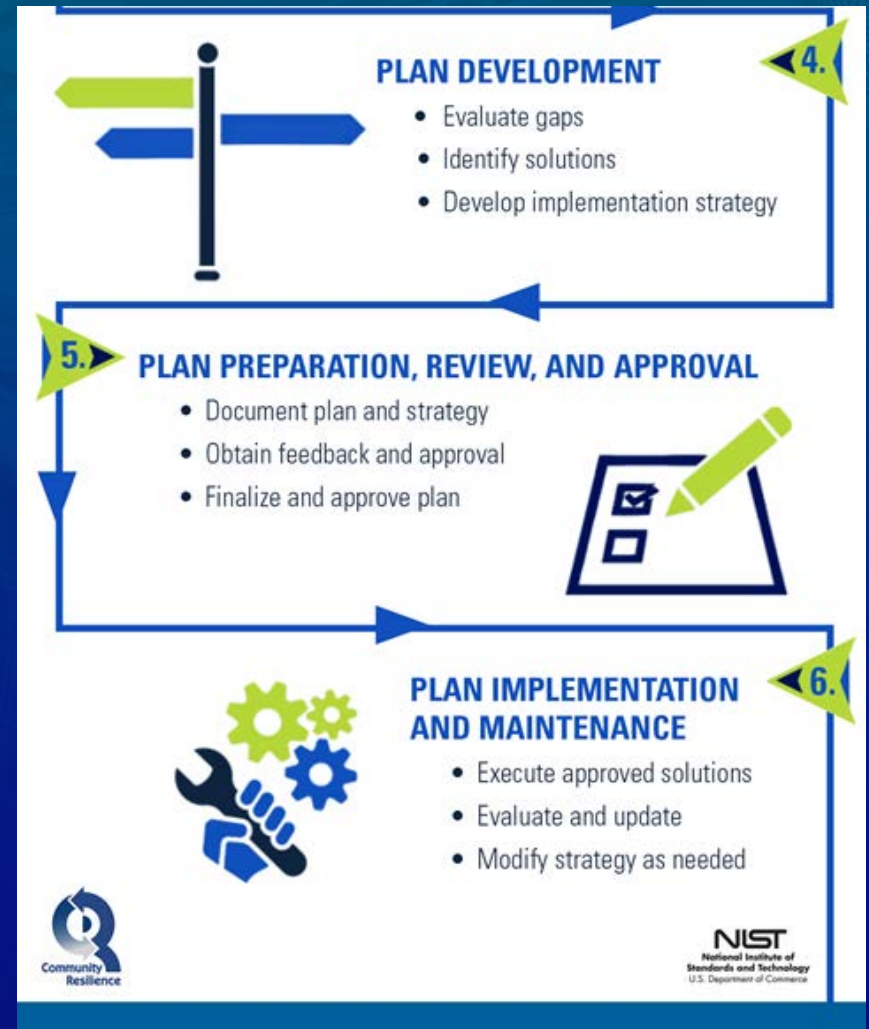
### Executive Summary

- **Social** Community
- Dependencies and Cascading Effects
- **Buildings**
- **Transportation** Systems
- **Energy** Systems
- **Communications** Systems
- **Water & Wastewater** Systems
- Community Resilience Metrics



# Planning Steps for Community Resilience

## SIX-STEP GUIDE TO PLANNING FOR COMMUNITY RESILIENCE



# Example Matrix: Building Performance Goals

Building Clusters	Support Needed <sup>4</sup>	Design Hazard Performance								
		Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term		
		Days			Weeks			Months		
		0	1	1-3	1-4	4-8	8-12	4	4-24	24+
		Building Performance Category								
		A			B		C			D
Critical Facilities										
Emergency Operation Centers	R, S, MS	90%							X	
First Responder Facilities	R, S, MS	90%							X	
Memorial Hospital	R, S, MS	90%							X	
Non-ambulatory Occupants (prisons, nursing homes, etc.)	R, S, MS	90%							X	
National Aircraft Parts Factory (NAP)	R, S, C	90%							X	
Emergency Housing										
Temporary Emergency Shelters	R, S	30%	90%							X
Single and Multi-family Housing (Shelter in place)	R, S	60%			90%					X
Housing/Neighborhood										
Critical Retail	R, S, C		30%	60%	90%					X
Religious and Spiritual Centers	R, S			30%	60%	90%				X
Single and Multi-family Housing (Full Function)	R, S			30%		60%		90%		X
Schools	R, S			30%	60%	90%				X
Hotels & Motels	R, S, C			30%		60%	90%			X
Community Recovery										
Businesses – Manufacturing (except NAP)	R, S, C				30%	60%	90%			X
Businesses - Commodity Services	R, S, C				30%	60%		90%		X
Businesses - Service Professions	R, S, C				30%		60%		90%	X
Conference & Event Venues	R, S, C				30%		60%		90%	X





# Example Matrix: Transportation Infrastructure

Transportation Infrastructure	Support Needed <sup>4</sup>	Design Hazard Performance								
		Phase 1 Short-Term			Phase 2 Intermediate			Phase 3 Long-Term		
		Days			Weeks			Months		
		0	1	1-3	1-4	4-8	8-12	4	4-24	24+
Ingress (goods, services, disaster relief)										
Local Roads	R, S	60%	90%	X						
State Highways and Bridge	R, S	60%	90%		X					
Regional Airport	R, S		30%	60%	90%		X			
Egress (emergency egress, evacuation, etc.)										
Local Roads	R, S	60%	90%	X						
State Highways and Bridge	R, S	60%	90%		X					
Regional Airport	R, S		30%	60%	90%		X			
Community resilience										
Critical Facilities										
Hospitals	R, S	60%	90%	X						
Police and Fire Stations	R, S	60%	90%	X						
Emergency Operational Centers	R, S	60%	90%	X						
Emergency Housing										
Residences	R, S	30%	60%	90%	X					
Emergency Responder Housing	R, S	30%	60%	90%	X					
Public Shelters	R, S	90%		X						
Housing/Neighborhoods										
Essential City Service Facilities	R, S	30%	60%	90%	X					
Schools	R, S	30%	60%	90%	X					
Medical Provider Offices	R, S	30%	60%	90%	X					
Retail	R, S	30%	60%	90%	X					
Community Recovery										
Residences	R, S	30%	60%	90%	X					
Neighborhood retail	R, S	30%	60%	90%	X					
Offices and work places	R, S	30%	60%	90%	X					
Non-emergency City Services	R, S	30%	60%	90%	X					
All businesses	R, S		30%	60%	90%	X				



# Example Summary Resilience Matrix

Infrastructure	Recovery Time								
	Days 0	Days 1	Days 1-3	Wks 1-4	Wks 4-8	Wks 8-12	Mos 4	Mos 4-24	Mos 24+
<b>Critical Facilities</b>									
Buildings	90%							X	
Transportation		90%	X						
Energy		90%	X						
Water			90%		X				
Wastewater				90%				X	
Communication		90%		X					
<b>Emergency Housing</b>									
Buildings				90%					
Transportation				X					
Energy				X					
Water					X				
Waste Water				90%					
Communication				90%	X				
<b>Housing/Neighborhoods</b>									
Buildings						90%			X
Transportation			90%	X					
Energy			90%	X					
Water				90%				X	
Waste Water					90%			X	
Communication				90%			X		
<b>Community Recovery</b>									
Buildings								90%	X
Transportation				90%	X				
Energy			90%	X					
Water				90%				X	
Waste Water							90%	X	
Communication				90%			X		

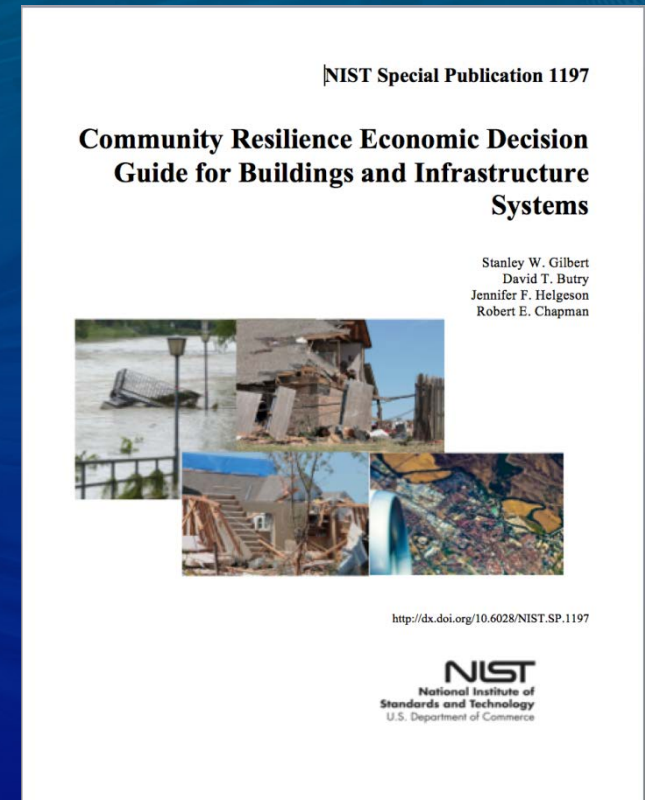
Desired  
Performance

Anticipated  
Performance



# Economic Decision Guide (EDG)

- Provides a standard methodology for evaluating investment decisions aimed at improving a community's resilience
- Designed for use with NIST's *Community Resilience Planning Guide for Buildings and Infrastructure Systems* – but can be used alone
  - Mechanism to evaluate efficiency of resilience actions and to prioritize them
- Frames the economic decision process
  - Identifies and compares resilience-related benefits and costs
    - Across competing alternatives
    - Versus the status quo (do-nothing)





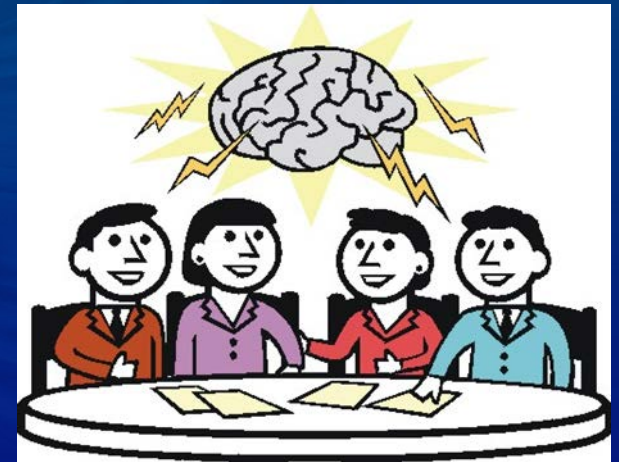
# EDGeS Tool

- Helps to use the NIST Economic Decision Guide and assist decision makers with resilience planning efforts
- Programmed in Python and packaged as an .exe
  - Ability to use “offline”
  - Possible plug-in to a GIS platform



# Using the Guide

- Encourage use of the Guide for community resilience planning.
- Collect data on its use to inform future versions of the Guide and other products.
- Current uses include:
  - Fort Collins, Colorado
  - Boulder County, Colorado
  - Delaware Department of Transportation
  - San Diego/Tijuana Earthquake Scenario
  - Others!



# NIST Contact

Website:

<http://www.nist.gov/el/resilience/>

Guide:

<http://www.nist.gov/el/resilience/guide.cfm>

Or google “NIST Resilience Planning Guide”

General E-mail: [resilience@nist.gov](mailto:resilience@nist.gov)

